Game Changing Development

Woven Thermal Protection System (WTPS)

Completed Technology Project (2011 - 2013)

Project Introduction

Woven Thermal Protection System (TPS) is a 14-month technology development project to prove the feasibility of woven material as a game changing approach for future planetary entry/return missions.

Planetary entry and near-Earth object return missions with an anticipated heat flux between 1,500 and 10,000 W/cm2 are currently limited to one viable TPS material - fully dense carbon phenolic (CP). However, high-density CP is only mass efficient at heat fluxes above 4000 W/cm2. This mid-density TPS performance gap can be filled using cost-effective weaving technology to produce high-grade, conformal, mid- to high-density TPS. Woven TPS not only bridges this gap but also offers a superior performing replacement for heritage CP. A woven TPS approach can result in TPS solutions that are optimized to a given mission's environments but with much-reduced costs compared to current TPS development and certification approaches. The woven TPS approach utilizes a stable U.S. weaving industrial base and processes that has a proven legacy and longevity in manufacturing commercial and advanced aerospace products. This industry has demonstrated capability to weave highly complex patterns in a 3D weave configuration for commercial applications. The Woven TPS Project will demonstrate this concept in partnership with a reliable industrial weaver selected through a Request for Information process in a 14-month program. We will accomplish this by designing and manufacturing a series of low-, mid- and high-density samples of woven carbon fiber material of varying yarn compositions, weave architectures, and level of resin infiltration and by testing them at extreme conditions. It is the project's goal to develop a preliminary database, compare the performance of woven TPS against heritage fully dense CP, and raise the woven TPS from Technology Readiness Level (TRL) 2 at the start of the project to TRL 3 at project completion.

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

Game Changing Development

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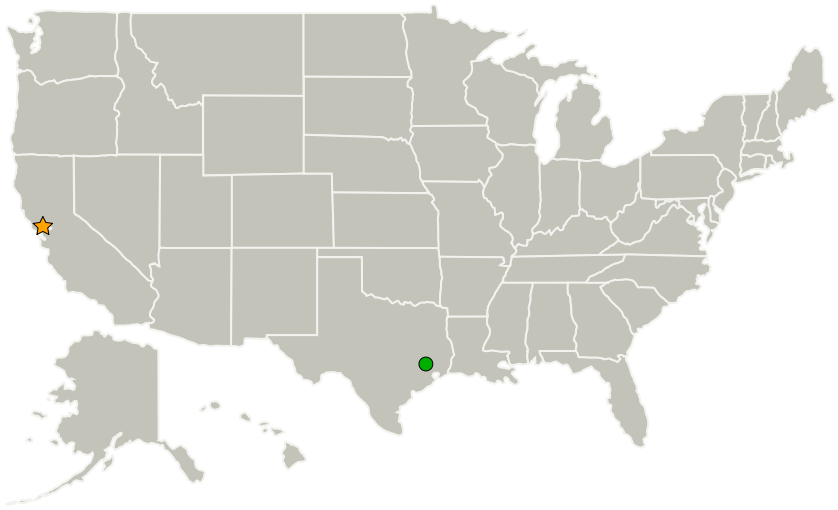
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
●Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Project Management

Program Director:
Mary J Werkheiser

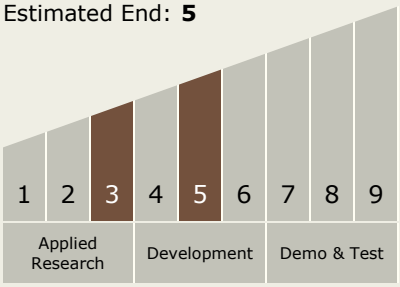
Program Manager:
Gary F Meyering

Project Manager:
Ethiraj Venkatapathy

Principal Investigator:
Michelle M Munk

Technology Maturity (TRL)

Start: **3**
Estimated End: **5**



Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.4 Vehicle Systems
    - TX09.4.6 Instrumentation and Health Monitoring for EDL